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NOTES ON GEOGRAPHIC DISTRIBUTION

Lophostoma carrikeri (Allen, 1910) (Chiroptera: Phyllostomidae): First confirmed records in Ecuador

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ABSTRACT: Herein we confirm the occurrence of *Lophostoma carrikeri* in Ecuador. One adult female was collected in Orellana province on 17 September 2012 at Boanamo, Waorani Ethnic Reserve, and another on 5 May 2013 at Yasuni Research Station, Yasuni National Park. These records extend the distributional range of the species about 570 km northwest of the nearest previously known record in Jenaro Herrera, Loreto, Peru. Both Ecuadorian localities are characterized by well-conserved primary Terra Firme rainforest. Morphological characters of the specimens presented here broaden the known intraspecific variation in this taxon, including uniformly dark ears without white margins, undeveloped sagittal crests, and smaller forearm size than previously reported. In addition, information on ectoparasites for this species in Ecuador is provided.

Round-eared bats, genus *Lophostoma* d'Orbigny, 1836, include eight species (Velazco and Gardner 2012), four of which have been reported to occur in Ecuador: *Lophostoma brasiliense* Peters, 1867 is widely distributed in eastern lowland rainforest, between 200 and 700 m (Williams and Genoways 2008; Tirira 2012), and recently has been recorded from several localities in the western lowlands, between 50 and 500 m (Carrera *et al.* 2010; Velazco and Cadenillas 2011; Regalado and Albuja, 2012); *L. silvicolum* d'Orbigny, 1836, in the eastern lowlands extending into the Andean foothills, between 200 and 1,250 m (Davis and Carter 1978; Medellín and Arita 1989; Tirira 2012); *L. occidentalis* (Davis & Carter, 1978) known from the Pacific coast between 5 and 1,300 m (Velazco and Cadenillas 2011; Tirira 2012); and *L. yasuni* Fonseca & Pinto, 2004, known only from the type locality at Yasuni Research Station (YRS), Orellana province, in the eastern lowlands (250 m).

Rex *et al.* (2008) reported the presence of a fifth species of *Lophostoma* for Ecuador, *L. carrikeri* (Allen, 1910), from the capture of three individuals: A pregnant female captured at the Tiputini Biodiversity Station (TBS, 00°38.21′ S, 76°8.92′ W, 190–270 m), Orellana province in eastern Ecuador, and a pregnant female and an adult male captured at Bombuscaro River in the Podocarpus National Park (BOM, 04°1′ S, 79°1′ W, 900–1,200 m), Zamora Chinchipe province, on the eastern slope of the Andean mountains of southern Ecuador. However, as mentioned by the authors, not all species reported in their study were collected and preserved as museum voucher specimens: "species that were difficult to identify or were considered new for each site" were reportedly deposited in the American Museum of Natural History (AMNH), New York, USA (Rex *et al*. 2008). However, individuals of the captured *Lophostoma* species were never formally accessioned at AMNH (Nancy B. Simmons, pers. comm.). Rex *et al*. (2008) were not clear as to the dispositional status of these specimens, and it is possible that they were released *in situ* after their identification (Christian C. Voigt, pers. comm.), making difficult the confirmation of *L. carrikeri* in Ecuador. Confirmation is further complicated due to the existence two *Lophostoma* species with external characteristics similar to *L. carrikeri* (*i.e.* white venter, overlapping measurements, etc.): *L. kalkoae* known only from its type locality in Panama and *L. yasuni* also known only from its type locality in eastern Ecuador.

Herein we report the first confirmed records of *L. carrikeri*, represented by museum voucher specimens deposited at the Mammalogy Division of Museo de Zoología at the Pontificia Universidad Católica del Ecuador (QCAZ).

The first specimen is an adult lactating female (Figure 1) identified with catalogue number QCAZ 13578, collected on 17 September 2012 in Boanamo, Waorani Ethnic Reserve, near the Yasuni National Park, Orellana province, Ecuador (01°14′50″ S, 76°22′30″ W, 230 m; Figure 2). External measurements (in mm) of the specimen are as follows: Total length, 86.4; tail length, 16; hindfoot length, 12.2; tibia length, 20.1; ear length, 24.4; forearm length, 42.8; calcar length, 13.3; metacarpal III length, 34.1; metacarpal IV length, 36.0; metacarpal V length, 37.9; and a mass of 17 g. Craniodental measurements (in mm) are provided in Table 1. Sampling effort consisted of 12 effective net-nights, employing 10 nets that were opened for 4 hours per night. During fieldwork, 160 bats were captured, representing five families, 22 genera, and 30 species. The only individual of *L. carrikeri* was captured in a ground-level mist net along the Mono Araña trail in primary Terra Firme rainforest. The vegetation surrounding Boanamo consists of primary tropical rainforest with an understory of mature woody and herbaceous vegetation. The capture site was near a small stream.

Figure 1. Photograph of an adult female *Lophostoma carrikeri* (QCAZ 13578) from Boanamo, Waorani Ethnic Reserve, near the Yasuni National Park, Orellana province, Ecuador. Photo by: Diego G. Tirira.

The second specimen is an adult lactating female, identified with catalogue number QCAZ 13994; collected on 5 June 2013. The specimen was captured in a mist net along the Ceiba trail (00°40′47″ S, 76°23′41″ W, 265 m; Figure 2) at the Yasuni Research Station, Yasuni National Park, Orellana province (63.4 km distant from Boanamo). The trail is 1 km in length and loops from the station to the road. The mist net capturing the bat was located 300 m from the road. External measurements are as follows: Total length, 84.0; tail length, 14.0; hindfoot length, 15.0; tibia length, 20.8; ear length, 25.0; forearm length, 44.0; calcar length, 14.7; metacarpal III length, 35.4; metacarpal IV length, 37.5; metacarpal V length, 39.5; and a mass of 20 g. Craniodental measurements are provided in Table 1. Sampling effort at this location consisted of 20 effective net-nights from 18 May to 5 June 2013, employing 12 nets for 7 hours per night. Mist nets were placed at ground level along trails in the open understory and across streams. A total of 446 bats, from three families, 24 genera, and 34 species were collected. The vegetation surrounding the Yasuni Research Station consists of primary and secondary tropical rainforest with an understory mainly of immature woody and herbaceous vegetation.

Both specimens exhibit entirely white furred underparts, except on chin and sides of the abdomen. Flanks, shoulders, and anal region have a pale grayish-brown pelage. Head and dorsal fur matches the description of the holotype as dark brown dorsally with tricolored hairs (pale at the base, grey in the middle, with whitish tips). Ears are uniformly dark, sparsely haired and without white margins; this feature is consistent with the description of the first record of *L. carrikeri* in the Cerrado of central Brazil (Zortéa *et al.* 2009). The proximal third dorsal surface of the forearm is hairy. Both specimens had an elongated clitoris and swollen labia (see Velazco and Gardner 2012).

Skulls show slender rostra and are constricted postorbitally; sagittal crests are not developed as were reported for other females of this species (Allen 1910; McCarthy *et al.* 1992). Lateral development of the mastoid region is moderate, intermediate between *L. brasiliense* and the other species (Fonseca and Pinto 2004; Velazco and Gardner 2012). Basisphenoid pits are well developed, divided by a visible but narrow septum. Upper toothrow is curved outward in QCAZ 13578 but not so in QCAZ 13994 (Fonseca and Pinto [2004] reported an outward curvature as a distinctive feature of *L. yasuni*). In both cases, the lingual cingulum of the upper canine has a weak indentation.

Lophostoma carrikeri (Allen, 1910), is restricted to South America and known from Colombia (McCarthy *et al.* 1983), Venezuela (Allen 1910; Gardner 1988), Guyana (Lim *et al.* 1999), Suriname (Genoways and Williams 1984; Lim *et al.* 2005), French Guiana (Williams and Genoways 2008), Brazil (Vizotto *et al.* 1980; Gribel and Taddei 1989;

Table 1. Measurements of specimens of *Lophostoma carrikeri* from Ecuador. Craniodental measurements of *L. carrikeri* and *L. yasuni* from Velazco and Gardner (2012) are included for comparison. Measurement definitions and graphic representations are provided by Velazco and Gardner (2012).

Character	QCAZ 13578	QCAZ 13994	Range *L. carrikeri*	*L. yasuni*
Greatest length of skull	23.2	24.1	23.0–25.3	26.6
Condyloincisive length	19.8	20.3	20.2–21.9	23.5
Condylocanine length	19.0	19.4	19.5–21.3	22.6
Braincase breadth	9.2	9.7	9.1–10.3	10.0
Zygomatic breadth	10.5	10.9	10.2–12.1	12.7
Postorbital breadth	3.4	3.9	3.3–4.1	4.0
Mastoid width	9.1	9.6	9.0–10.1	10.3
Mastoid process width	11.1	11.5	10.8–12.8	12.7
Palatal length	9.4	9.9	10.0–11.1	11.8
Maxillary toothrow length	7.7	8.0	7.9–8.6	9.4
Molariform toothrow length	6.5	6.5	6.6–7.3	7.9
Width at M2	7.1	7.3	7.1–7.9	8.8
Dentary length	13.9	14.6	13.8–15.9	16.9
Mandibular toothrow length	8.6	8.9	8.8–9.7	10.7

Zortéa *et al.* 2009), Peru (Gardner 1976; Solari *et al*. 2006), and Bolivia (Koopman 1976). The presence of *L. carrikeri* in Ecuador was expected because of its occurrence in neighboring countries. Records of *L. carrikeri* reported herein extend the geographic range of the species approximately 570 km from the nearest marginal locality of Jenaro Herrera, in Loreto, Peru (Williams and Genoways 2008; Figure 2). The Ecuadorian vouchers are deposited in the Mammalogy Division of Museo de Zoología at the Pontificia Universidad Católica del Ecuador (QCAZ 13578 and QCAZ 13994), both stored as fluid vouchers (75% ethanol) with skulls removed. These specimens were collected under Research Permits 005-2012-IC-FAU-MAE-DPAO-PNY and 020-2013-FAU-MAE-DPAO-PNY issued by the Ministerio del Ambiente of Ecuador (MAE).

In October 2004, Rex *et al.* (2008) identified two captures *in situ* as *L. carrikeri*, one in TBS and one in BOM. In April 2005, another individual identified as *L. carrikeri* was captured in BOM. At that time, *L. carrikeri* was the only known white-bellied *Lophostoma* likely to occur in those sites. However, in December 2004, a new white-bellied species, *L. yasuni*, was described from Yasuni National Park (Fonseca and Pinto 2004). Although their project was primarily ecological in scope, Rex *et al*. (2008) did not take into account the possibility that two white-bellied *Lophostoma* may have existed at their study sites, and particularly at TBS given its proximity to the type locality of *L. yasuni*. It is important to emphasize that the confirmation of this species in Ecuador is based on the analysis of voucher specimens collected and deposited in an accredited scientific collection. Specimens in natural history museums allow members of the scientific community to test, refute, or confirm original information by the examination of physical specimens (Allmon 1994). Records from Rex *et al*. (2008) must be considered anecdotal because no vouchers were deposited at a natural history museum, and misidentification of bat specimens in the field is not uncommon.

Lophostoma carrikeri was included in the Ecuadorian mammal fauna by Albuja (2011), based on the records of Rex *et al.* (2008). Tirira (2012) was more cautious, stating that its inclusion in the Ecuadorian fauna should be provisional until the identity of captures could be confirmed. In the most recent revision of the genus, Velazco and Gardner (2012) did not include the records mentioned by Rex *et al.* (2008), since there were no specimens to confirm the record.

Variation in some measurements and skull characters from both specimens, particularly smaller forearm size in QCAZ 13578 (Boanamo) and upper toothrow shape in QCAZ 13994 (Yasuni Research Station), suggests that it is necessary to review the validity of the diagnostic characters of *L. yasuni*: forearm shorter than 44 mm, greatest length of skull 25.5 mm or more (Velazco and Gardner 2012),

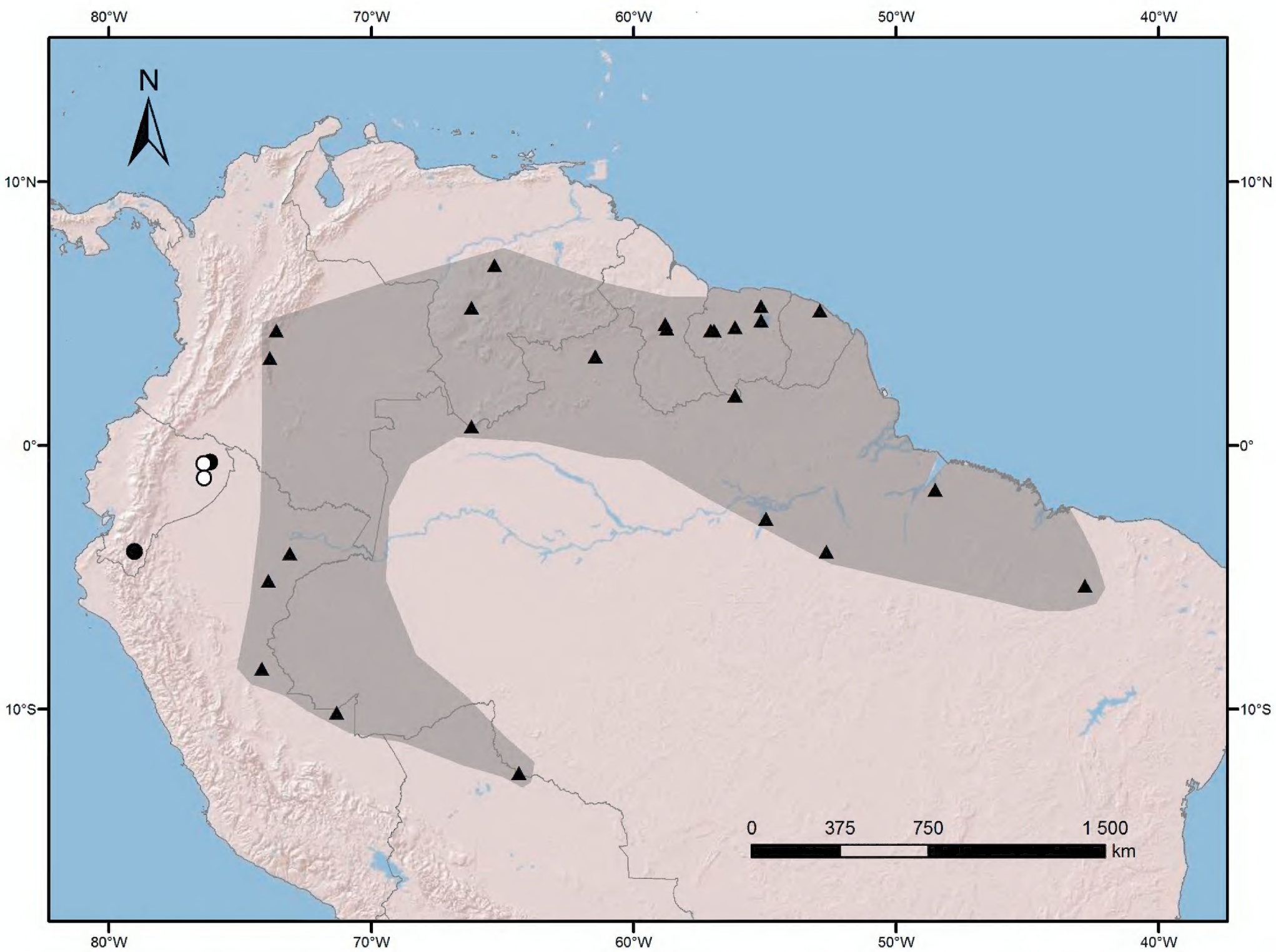

Figure 2. Extended distributional range of *Lophostoma carrikeri*. Triangles represent all reported localities for the species (Velazco and Gardner 2012). White dots correspond to new records herein reported. Black dots correspond to unconfirmed records reported by Rex *et al*. (2008).

and upper toothrow curved outward (Fonseca and Pinto 2004). It would also be useful to procure a series of *L. yasuni* specimens to better understand morphological variation within the species, currently known from a single individual. Molecular analysis of the white-bellied round-eared bats of Ecuador is necessary to provide a complete set of data to clarify and identify their phylogenetic relationships.

Ectoparasitic arthropods were collected from QCAZ 13994. They comprised three genera and species of bat flies (Diptera: Streblidae): 3 males and 1 female *Stizostrebla longirostris* Jobling, 1939; 1 male *Pseudostrebla sparsisetis* Wenzel, 1976; and 12 males and 10 females *Mastoptera* sp. (*minuta* complex *sensu* Wenzel, 1976). *Mastoptera* spp. *minuta* complex comprise several cryptic species that parasitize a variety of species of *Phyllostomus* and *Lophostoma*. *Stizostrebla longirostris* is a rare species known from 22 specimens from Brazil, Colombia, Peru, Venezuela, and Ecuador. This is the first report of this genus and species from Ecuador. *Pseudostrebla sparsisetis* is also rare, known from 11 specimens from Colombia, Venezuela, and Ecuador. This is the first report of this species from Ecuador. *Stizostrebla longirostris* and *Pseudostrebla sparsisetis* are exclusive parasites of *Lophostoma carrikeri*.

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